# Gross Anatomy and Classification of the Commensal Gastropod, *Caledoniella montrouzieri* Souverbie, 1869

BY

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(Plate 55; 4 Text figures)

Specimens of a commensal gastropod were reported by Manning (1968) on two species of *Gonodactylus* (Crustacea: Stomatopoda) from the southwest Indian Ocean. Upon examination these were found to be *Caledoniella montrouzieri* Souverbie, 1869, originally described from New Caledonia, a species whose anatomy was virtually unknown and whose systematic relationships are poorly understood. In the present paper an attempt is made to describe the gross anatomy of this species, comment on its supposed habits and to suggest for it a familial allocation.

## HISTORICAL

The monotypic genus *Caledoniella* was described briefly by Souverbie (1869) with *C. montrouzieri* as its only contained species. In the following year Souverbie & Montrouzier (1870) supplemented the original description and published a figure of the shell, commenting that the animal had been found living on the thoracic appendages of *Gonodactylus*. They made no assignment of the taxon to a higher category. Tryon (1886) assigned the species to the subfamily Lamellariinae of his family Naticidae with some doubt because the animal was unknown. As noted by Allan (1936), Basedow (1905) described a second supposed species of *Caledoniella* which subsequently has been found not to belong to that genus. Preston (1912) described *Epistethe gonodactyli* from the Persian Gulf and Andaman Islands, and it is now considered to be an absolute synonym of *C. montrouzieri*. He gave the first sketchy description of the animal, but did not assign it to a family. Allan (*op. cit.*) reported specimens of *Caledoniella* attached to a *Gonodactylus* from Albany Passage, Cape York, Queensland. In all probability these are *C. montrouzieri* (see Text figure 1).

Latest attempts at suprageneric classification of *Caledoniella* are those of Thiele (1929) and Wenz (1940). Thiele placed it in the Superfamily Lamellariacea, subfamily Lamellariinae and described a radula (see below under **Radula**). The assignment quite probably was made on the basis of shell shape since *Caledoniella* resembles *Lamellaria*. Wenz placed it in the Superfamily Pyramidellacea, Family Stiliferidae, probably because of the commensal relationship with *Gonodactylus*.

Holthuis (1951) reviewed the known information relating to the geographic occurrence of *Caledoniella montrouzieri* and mentioned the presence of gastropod egg-capsules on the ventral surface of several of its host *Gonodactylus*. The same author (1941) figured similar egg-capsules and suggested that they were probably those of *Epistethe* (= *Caledoniella*; see Text figure 4).

## ACKNOWLEDGMENTS

I express my appreciation to Raymond B. Manning for calling to my attention the specimens of gastropods upon which this paper is based and to both him and L. B. Holthuis for discussing the relationship with *Gonodactylus*. I am also grateful to Mrs. Carolyn Bartlett Gast for preparing the plate illustrating animal and shells of *Caledoniella montrouzieri*. Ideas and interpretations are mine alone and I accept full responsibility for them.

## EXTERNAL ANATOMY

**Material:**

| | Shell H' | Shell W* | Locality | |
|---|---|---|---|---|
| 1. Male (Plate 55, Figs. A - F) | 2.6 | 4.3 | Anjouan Id., Comoro Ids. | USNM 679176 |
| 2. Female (not figured) | 2.8 | 5.2 | Anjouan Id., Comoro Ids. | USNM 679176 |
| 3. Male (Plate 55, Figs. G - I) | 1.4 | 2.2 | Tulear, Madagascar | USNM 679177 |
| 4. Female (Plate 55, Figs. J - L) | 2.8 | 4.6 | Tulear, Madagascar | USNM 678177 |

H' = height in mm; W* = width in mm

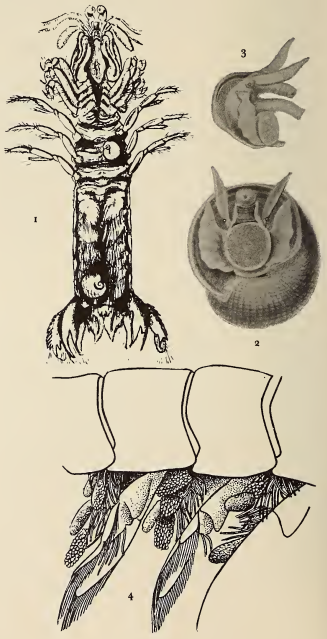
The male animal from Anjouan, Comoro Islands, was used mainly for the following description and accompanying Plate. The three other available specimens were compared and found to agree.

**Foot:** PRESTON's (1912) description, although brief, characterized the foot and its epipodial fringe. He described the foot as an "adhesive organ", and this may be the case (see Plate 55, Figure C). The ventral surface of the foot (mesopodium) is disklike, and in one of the specimens examined was covered with a thin, chitinous "epidermis" which may be secreted for attachment to the host. Attachment is here not considered to be permanent, as evidence gained from a specimen examined *in situ* indicates these gastropods move about on the host (see **Reproduction**). At the anterior edge of the foot there is a groove which ascends dorsally to the base of the propodium.

**"Epipodial Fringe":** As described by PRESTON (1912) there occurs dorsal to the foot-disk, laterally and posteriorly, a foliated (in preserved specimens) fringe of tissue which he termed the "epipodial fringe" (Plate 55, Figures A to C). This structure appears to be the metapodium. Its function in living *Caledoniella* has not been reported, but may be analogous to that in *Natica* (FRETTER & GRAHAM, 1962, fig. 304) in partially covering the shell. A somewhat similar metapodial fringe was described and figured by QUOY & GAIMARD (1832, 1833) and by BERGH (1896) in *Vanikoro cancellata* (LAMARCK, 1822) (see ROBERTSON, 1962 and Text figures 2, 3).

An operculum was not observed in *Caledoniella montrouzieri*. It is probable that the operculum has been lost during the evolution of the species in connection with its adaptation to existence as a commensal.

**Propodium:** Located antero-medially above the anterior edge of the foot and between the anterior edges of the "epipodial fringe" there is a partially bilobed structure which was dorso-ventrally folded in the preserved animal (Plate 55, Figures A to C). This is the propodium. When unfolded (Figure A), it forms a structure which appears to be highly utilitarian. YONGE (1953) has suggested that in *Hipponix antiquatus* (LINNAEUS, 1767) the propodium may be concerned with egg-capsule attachment. He did not mention the structure in males of *H. antiquatus*, although it may be shown in the figure of a male (see




Figures 1 to 4

YONGE, 1960, fig. 1). It is well developed in both male and female *Caledoniella montrouzieri*. Since it is probable that only the female takes part in egg-mass deposition, the presence of the propodium in males may signify protandry, or the structure may have some additional function, such as in feeding.

**Proboscis:** A prominent, muscular and extensible proboscis is present above the propodium with the mouth as a vertical slit at its extremity.

**Radula:** A radula was not found, although three of the animals were dissected in search of that structure. The only known report of a radula in *Caledoniella montrouzieri* is that of THIELE (1929): "Mittelplatte der Radula rundlich quadratisch, Schneide breit dreieckig, jederseits mit einigen Zähnchen, Zwischenplatte mäßig groß, Schneide spitz, mit einer inneren Nebenzacke, die beiden Seitenplatten mit einfachen hakenförmigen Spitzen." Unfortunately the radula was not figured, and THIELE's description contains no clue to the relationships of *Caledoniella*. I am somewhat confused by the absence of a radula in the specimens examined by me and am led to question THIELE's report until it is confirmed.

**Tentacles:** A pair of fleshy tentacles is located above the proboscis. Due to preservation it is difficult to be certain how extensible these may be in the living animal, but they are relatively long. Tentacles are joined by a connecting lobe between their bases. The eyes occur as black-pigmented spots buried within the semitransparent tissue of the tentacles and are located somewhat toward the outer edges of their bases. Similar eyes have been reported in *Vanikoro* (BERGH, 1896) and in *Natica* (FRETTER & GRAHAM, 1962).

**Penis:** The penis, located near the base of the right tentacle, is long and slender in the two male specimens examined (see Plate 55, Figures A to C). It is simple (i. e., unbranched) and semitransparent; there is a closed gonoduct passing through its tissue.

**Mantle and Mantle Cavity:** In the illustration (Plate 55, Figures A to C) the mantle edge is rolled back to reveal the animal's tentacles, eyes and penis. The mantle edge is grayish-white in color and somewhat thickened; behind the edge the outside of the mantle is darkly pigmented, the dark color showing through the transparent shell; it is semitransparent and thin in the region of the ctenidia. The ctenidia are not excessively developed, nor is the mantle cavity extremely large.

**Shell:** There is evidence of sexual dimorphism in the shells of male and female specimens, especially in size. All are wider than long. In shells of male *Caledoniella montrouzieri* (Plate 55, Figures D-I) the body whorl is by far the major constituent and the spire consists of the protoconch and only about one subsequent whorl. Shell color is pale yellowish-white and there is a shiny darker yellow periostracum which becomes deciduous upon drying. Sculpture is limited to fine, irregular axial lines of growth. The columellar lip may be roughly formed and rather deeply concave. Columellar muscle scar is elongate-oval, large and well defined; it is clearly visible within the aperture on inner wall of outer lip near posterior junction of outer lip and columella. The name "columellar muscle scar" in *C. montrouzieri* is somewhat a misnomer, as it is not altogether located on the columella! The muscle probably performs the same function as in other prosobranchs, that of pulling the animal into its shell.

In the female shell (Plate 55, Figures J to L) the spire of the specimen from Tulear is definitely lifted above the posterior limit of the aperture. There are about 3 whorls present, but the columella is considerably shorter. A small columellar muscle scar is visible within the aperture in a position similar to that in the male specimen. The shell is very narrowly umbilicate, while in the males there is no umbilical opening. The shell of the female from Anjouan is much the same as that of the male, but larger.

**Protoconch:** The protoconch in the two male specimens available for study is unsculptured, smoothly rounded and hardly raised, consisting of about 1½ whorls. There is a sharp change in sculpture between protoconch and adult shell, the latter being defined by the beginning of the fine growth lines (Plate 55, Figures D, G). The female protoconch differs only in being partly covered by the adult shell, a phenomenon possibly related to sexual dimorphism.

## GEOGRAPHICAL DISTRIBUTION

Distributional data accumulated to date indicate a rather extensive range for *Caledoniella montrouzieri* from the western Indian Ocean through the East Indies to western Polynesia in the tropical Indo-Pacific. Until recently the gastropod was reported only on *Gonodactylus chiragra* or *Gonodactylus* "species." MANNING (1968) has distinguished two additional host species. It is apparent, therefore, that the relationship is not specific so far as the species of *Gonodactylus* is concerned.

**Locality Records:** Persian Gulf (PRESTON, 1912; on *Gonodactylus chiragra* (FABRICIUS)). Comoro Islands: Anjouan Island (MANNING, 1968; on *G. platysoma* WOOD-MASON). Madagascar: Tulear (MANNING, 1968; on *G. smithii* POCOCK). Andaman Islands (PRESTON, 1912; on *G. chiragra*). Australia: Albany Passage, Cape York, Queensland (ALLAN, 1936; *Gonodactylus* sp.). In-

donesia: Amboina (Holthuis, 1941; *G. chiragra*). New Caledonia: Art Island (Souverbie, 1869; Souverbie & Montrouzier, 1870; *Gonodactylus* sp.). Samoa: Matapao, Savaii (Holthuis, 1951; *G. chiragra*).

## REPRODUCTION

Yonge (1953, 1960) has discussed the problems associated with reproduction in a sedentary gastropod. He demonstrated how in *Hipponix antiquatus,* a species which lives permanently attached to hard substrates, and in which protandric hermaphroditism is the apparent condition, fertilization is probably effected by individuals of the male phase extending the long penis to the mantle cavity and oviduct of an adjacent female. Yonge suggested that, although sedentary, these gastropods occurred in sufficient density to make feasible such an arrangement for the adequate perpetuation of the species.

Available data indicate that *Caledoniella montrouzieri* always lives on *Gonodactylus*; at least none has been reported in any other habitat. Information concerning placement of the gastropod on its host seems to indicate a trend. More than one *Caledoniella* per *Gonodactylus* has been reported in the literature 4 times: (1) by Allan (1936), (2) by Holthuis (1941, 1951 same case), and (3, 4) by Manning (1968, specimens described and figured here). In three of these cases the larger of the two gastropods, here believed to be female, was located near the ventral posterior end of the crustaceans' abdomen between the pleopods; the smaller gastropod, believed to be male, was always located near the ventral posterior end of the thorax, between the periopods. In the fourth case, Manning (1968) found two gastropods between the pleopods of *G. platysoma.* Of the last two specimens reported, only one, a male (Plate 55, Figures A to F), was transmitted to me for study initially. It was located on the *Gonodactylus* on the posterior surface of the first right pleopod, and the place of attachment was later noted to be marked on the pleopod by a mucoid deposit with the outline of the foot. The second specimen was not removed from the *Gonodactylus* and was not received for examination by me until much of the present paper had been written. It caused a change in certain of the concepts I had formed concerning the permanency of attachment to the host.

The specimen, a female, was located between the fourth and fifth pleopods on the right side of the ventral posterior abdomen of *Gonodactylus platysoma.* It did not appear to be attached by its foot to the host, but rather was very firmly grasping a single gill filament of the *Gonodactylus* between the lobes of its propodium. It is probable that the foot attachment was disturbed during collection or preservation. The animal probably was attached by its foot to the broad anterior surface of the fifth pleopod.

In all cases reported, therefore, of a male and female occurring together on *Gonodactylus,* the male shows a tendency to be located on the posterior thorax or in the last case, the anterior abdomen. The females have been found on the posterior abdomen. The following information concerning distribution of egg-masses indicates that it is most probable that the female, at least, moves about and is not sessile.

Egg-Masses: Holthuis (1941) mentioned and figured egg-masses, supposedly those of *Caledoniella montrouzieri,* on the abdominal pleopods of specimens of *Gonodactylus chiragra* from the Moluccas and from Samoa (see Text figure 4, from Holthuis, 1941). The egg-masses are similar to those described and figured by Yonge (1953, fig. 8) in *Hipponix antiquatus* except that *C. montrouzieri* deposits its masses outside of its own mantle cavity. Eleven masses are shown by Holthuis to be attached over an area comprising about 3 abdominal segments.

The specimen of *Gonodactylus platysoma* from Anjouan Island had distributed over its abdominal segments a total of 35 egg-masses. These were attached to the more medial gill filaments of all but the first pair of pleopods. Their distribution was as follows:

| | Left | Right | |
|---|---|---|---|
| Pleopod Number 1 | 0 | 0 | |
| Pleopod Number 2 | 3 | 4 | |
| Pleopod Number 3 | 3 | 7 | |
| Pleopod Number 4 | 6 | 7 | |
| Pleopod Number 5 | 4 | 1 | |
| Total | 16 | 19 | = 35 |

Eggs within the capsules were in all stages of development. Some capsules contained material having no definite form, others contained fully formed young snails whose shells, consisting of about 1 whorl, resembled the protoconchs of the adults; several of the capsules were empty and evidenced terminal apertures through which the young may have escaped. Considering the advanced stage of development of the young in several of the capsules it is almost certain that when hatched from the capsules they are already at the crawling stage. The large number of capsules, together with their widespread placement on the host, would indicate the female moves about over the surface of the pleopods during their deposition. It is most probable that fertilization takes place when the female approaches the position of the male in

Through an oversight, the explanations to the Text figures and the Plate figures were omitted in our April issue of Volume 11. We apologize to the author, Dr. Joseph Rosewater, as well as to our readers.

Explanation of the Text figures
(see page 346)

Figure 1: *Caledoniella montrouzieri* on ventral side of *Gonodactylus* sp. from Albany Passage, Cape York, Queensland; note supposed male on thorax, female on posterior abdomen (from ALLAN, 1936, plt. 26, fig. 1).
Figures 2 and 3: *Vanikoro cancellata* LAMARCK; two views of animal; Figure 2, animal in aperture of shell, showing circular foot, propodium, epipodial fringe, operculum, proboscis, tentacles and eyes; Figure 3, animal withdrawn from shell and viewed from side (from QUOY & GAIMARD, Atlas, 1833, plt. 66 (bis), figs. 20, 21).
Figure 4: Egg-masses of *Caledoniella montrouzieri* on abdominal appendages of *Gonodactylus chiragra* (from HOLTHUIS, 1941, fig. 7).

Explanation of Plate 55

Figures A to F: *Caledoniella montrouzieri*, male from Anjouan Island, Comoros Islands.
Figures A to C: Front and side views showing propodium, foot, "epipodial fringe", proboscis, tentacles and penis.
Figure D: Enlarged view of protoconch.
Figures E and F: Two views of shell.
Figures G to I: Shell of male from Tulear, Madagascar.
Figures J to L: Shell of female from same locality.

(scale represents 1 mm; detail squares are 0.75 mm)